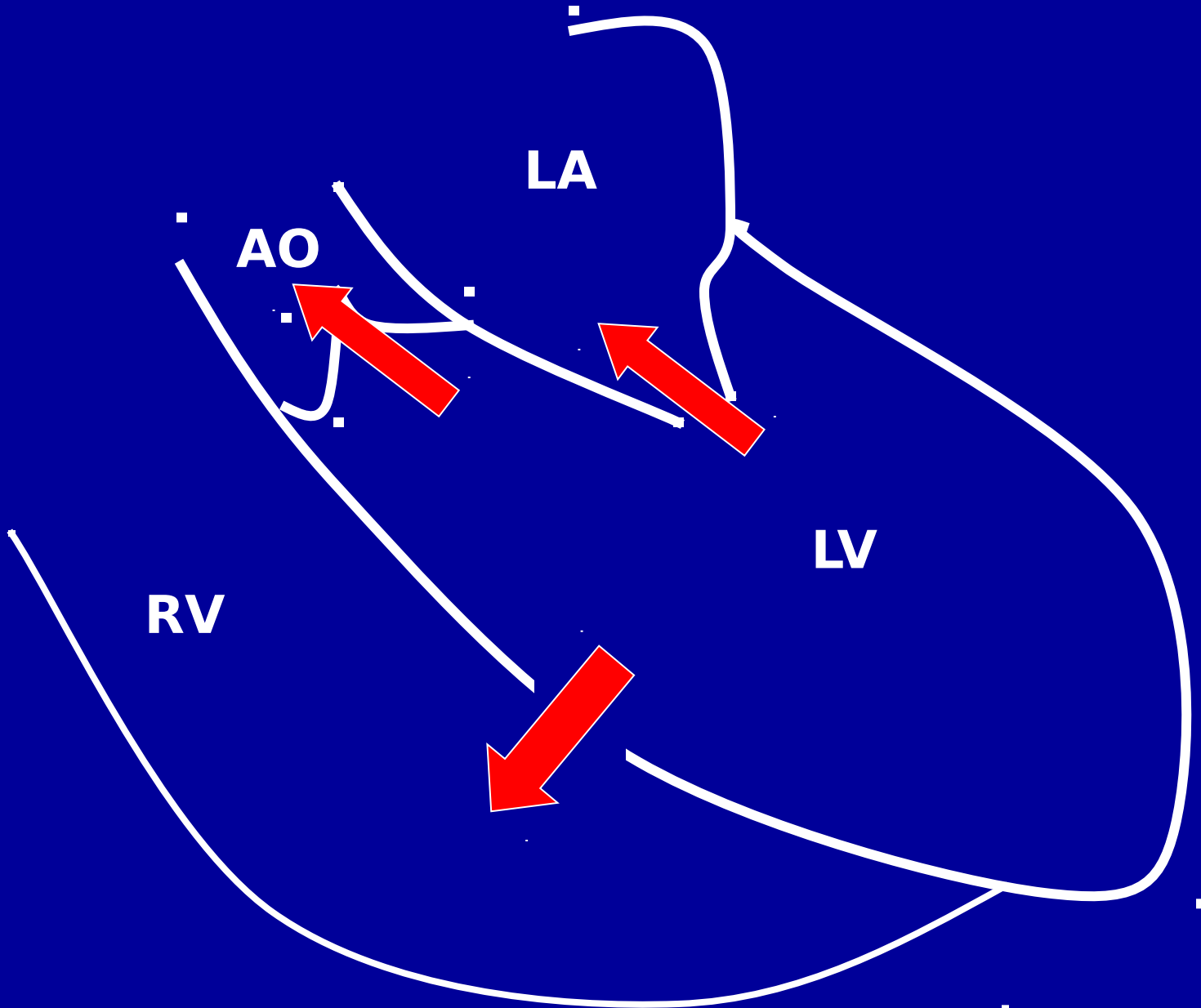


Cardiac Auscultation

Hostage Day 2

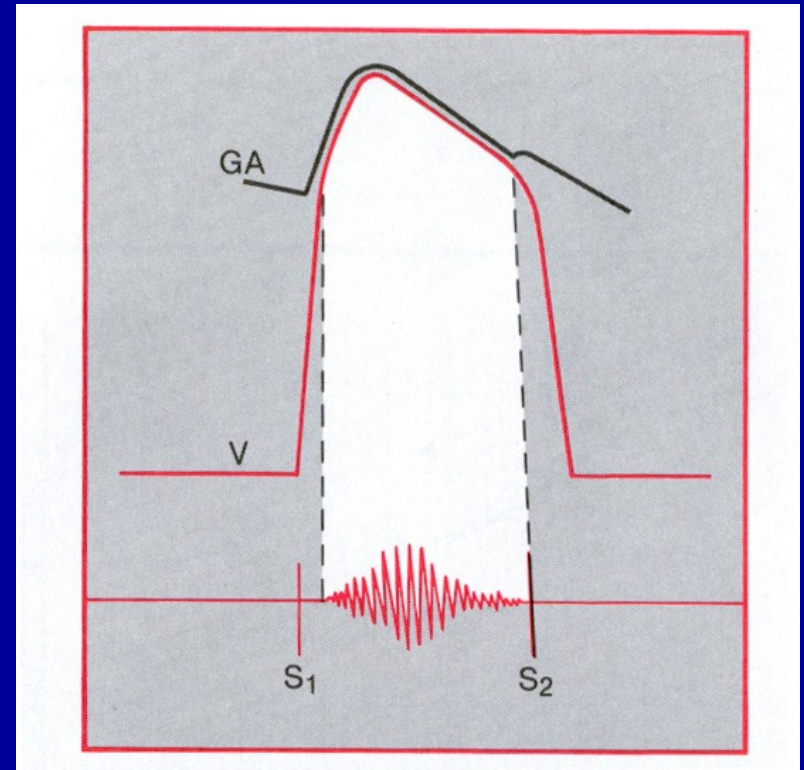
Mark Haigney, MD
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Systole



Mid-systolic Murmurs

- Mid-systole is the EJECTION PERIOD
 - MSM are therefore “Ejection Murmurs”
- Ejection starts after S1, peaks soon after, and diminishes before S2
 - Ejection murmurs MUST be crescendo-decrescendo
 - Holosystolic murmurs are NOT ejection murmurs



Why do MSM sometimes sound Holosystolic?

- Very loud MSMs (i.e. aortic stenosis) may sound holosystolic because they blow your ears off
 - Ability to discern modulation is saturated
 - Witness effect
- Experienced auscultators hear the right things because they know what to expect
 - “Chance observation favors the prepared mind.”
 - If one is expecting aortic stenosis, one will hear aortic stenosis

Aortic Stenosis

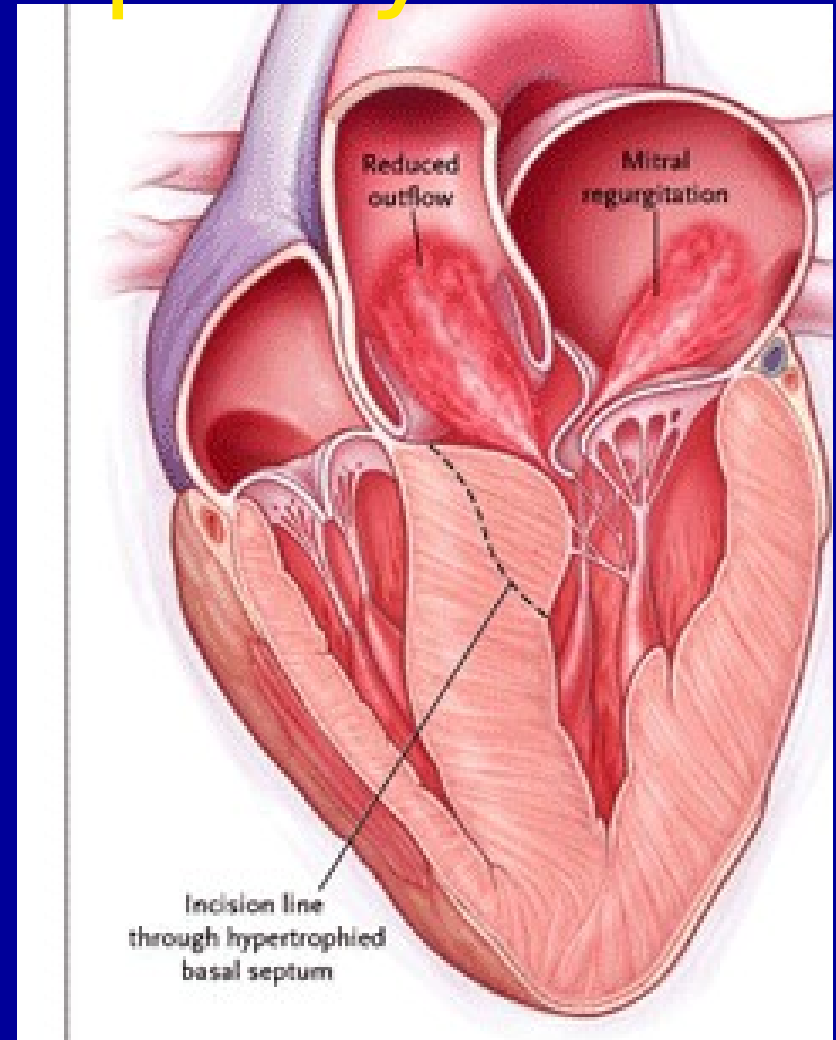
- Signs of severity
 - Signs/symptoms of heart failure
 - S4
- Critical AS
 - Delayed, small volume carotid upstrokes
 - “shuddering”
 - Loss of A2
 - Late peaking murmur

Hypertrophic Cardiomyopathy

- Autosomal dominant disorder of contractile proteins
 - Frequently causes asymmetric thickening of the interventricular septum, obstructing outflow
 - The most common cause of sudden death in American athletes

Hypertrophic Cardiomyopathy

- Bulging of septum into outflow tract occurs as systole progresses
- Causes MSM similar to AS but heard at LLSB; brisk carotid upstrokes; no ejection sound; murmur increases with standing or valsalva



Pulmonic Stenosis

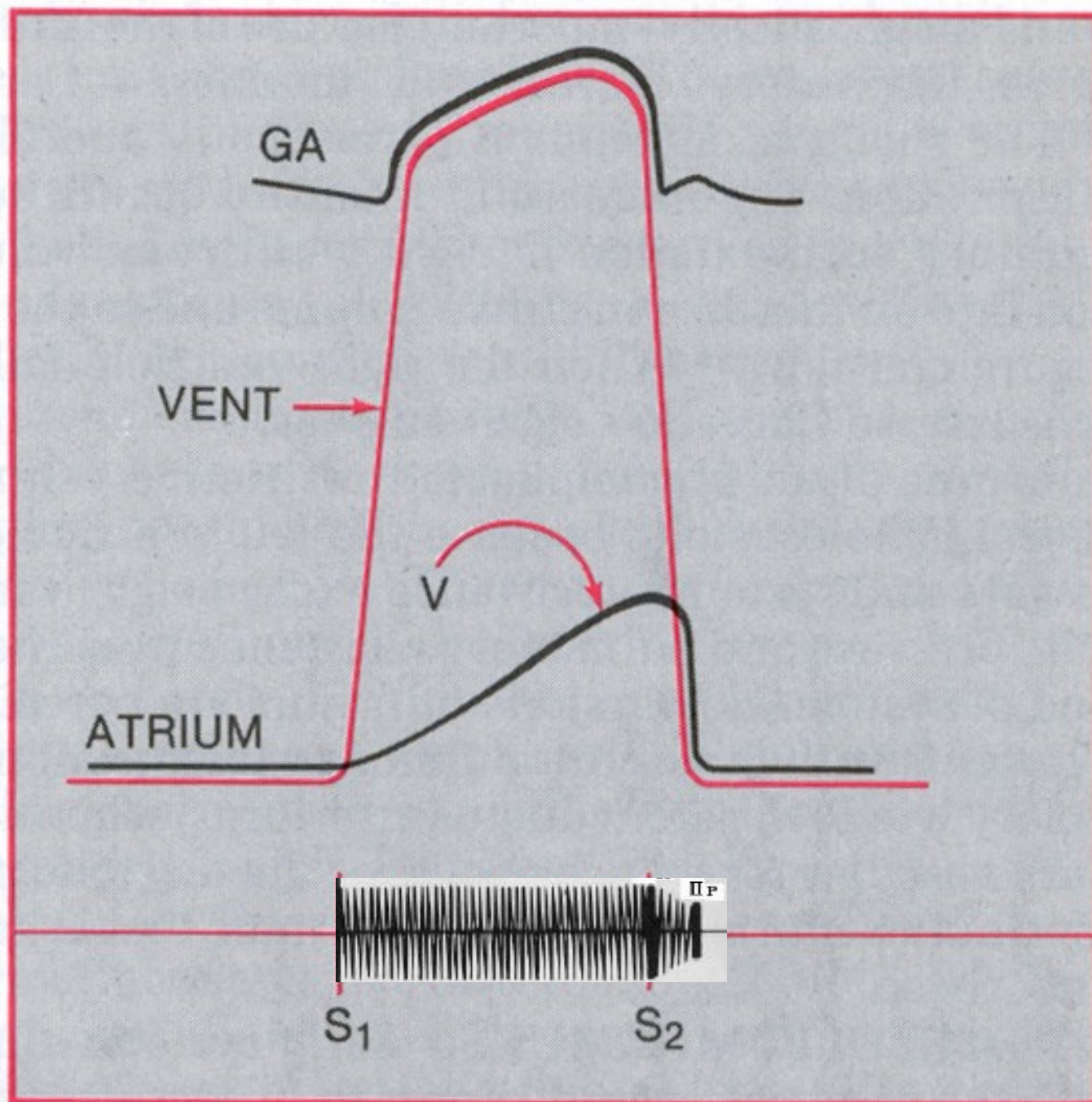
- Usually congenital, may be associated with other abnormalities
- Causes a mid-systolic ejection murmur similar to AS but does NOT radiate to carotids
 - Radiates to left infraclavicular area
 - Murmur intensity and ejection sound vary with respiration
 - Widened S2 split
 - Balloon valvuloplasty when gradient exceeds 30-50 mm Hg

Innocent Systolic Murmur

- Caused by high flow in outflow tracts
- Crescendo-decrescendo ejection murmur
 - Ubiquitous in pregnancy; common in children, anemia, fever, high output states
- Brief, early peaking
- Localized to either pulmonic or aortic areas
- NORMAL S2 splitting
- No other abnormalities present

Holosystolic Murmurs

- AKA “Pansystolic Murmurs”
- Begin with S1 and end after S2
- Caused by flow from high pressure area to much lower pressure area
 - Ventricle to atrium
 - Left ventricle to right ventricle
- Harsh, “blowing,” well-heard with diaphragm



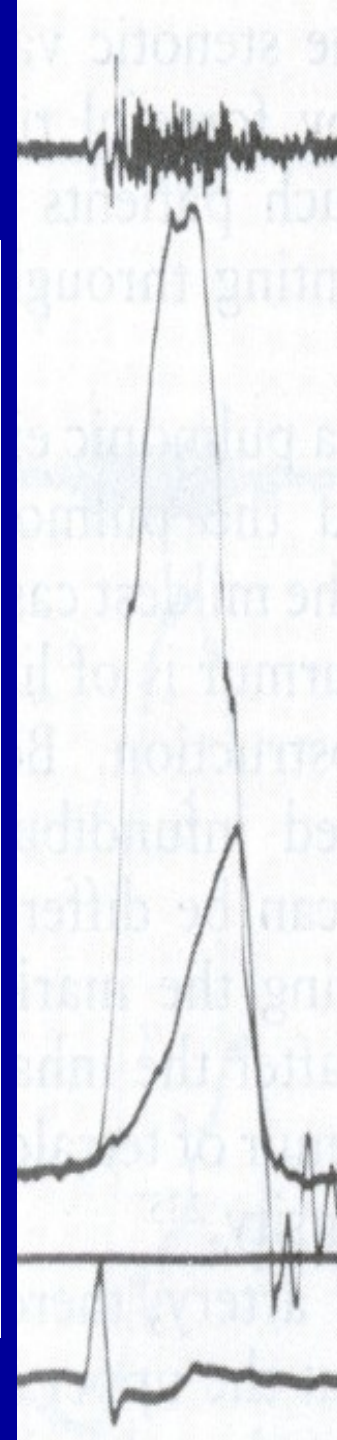
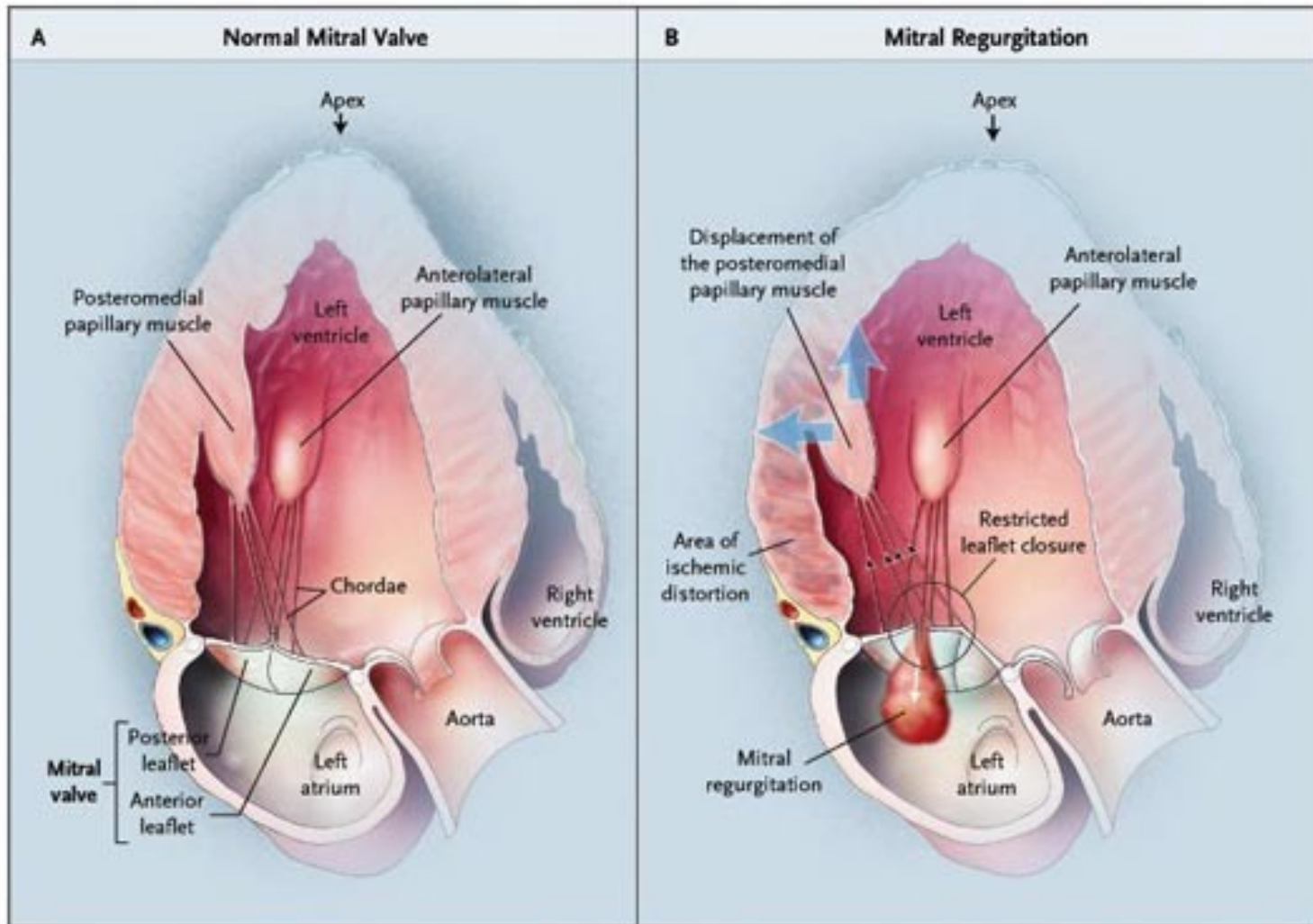
Holosystolic Murmurs

- Atrioventricular valve leakage
 - Mitral Regurgitation
 - Tricuspid Regurgitation
- Interventricular shunt
 - Ventricular septal defect

Chronic Mitral Regurgitation

- Progressive Mitral Valve Prolapse
most common cause
- LV dilatation, rheumatic, congenital,
endocarditis, infarction
- Results in chronic volume overload of
left ventricle
 - Acute MR may have very brief murmur
due to rapid equilibration of pressures

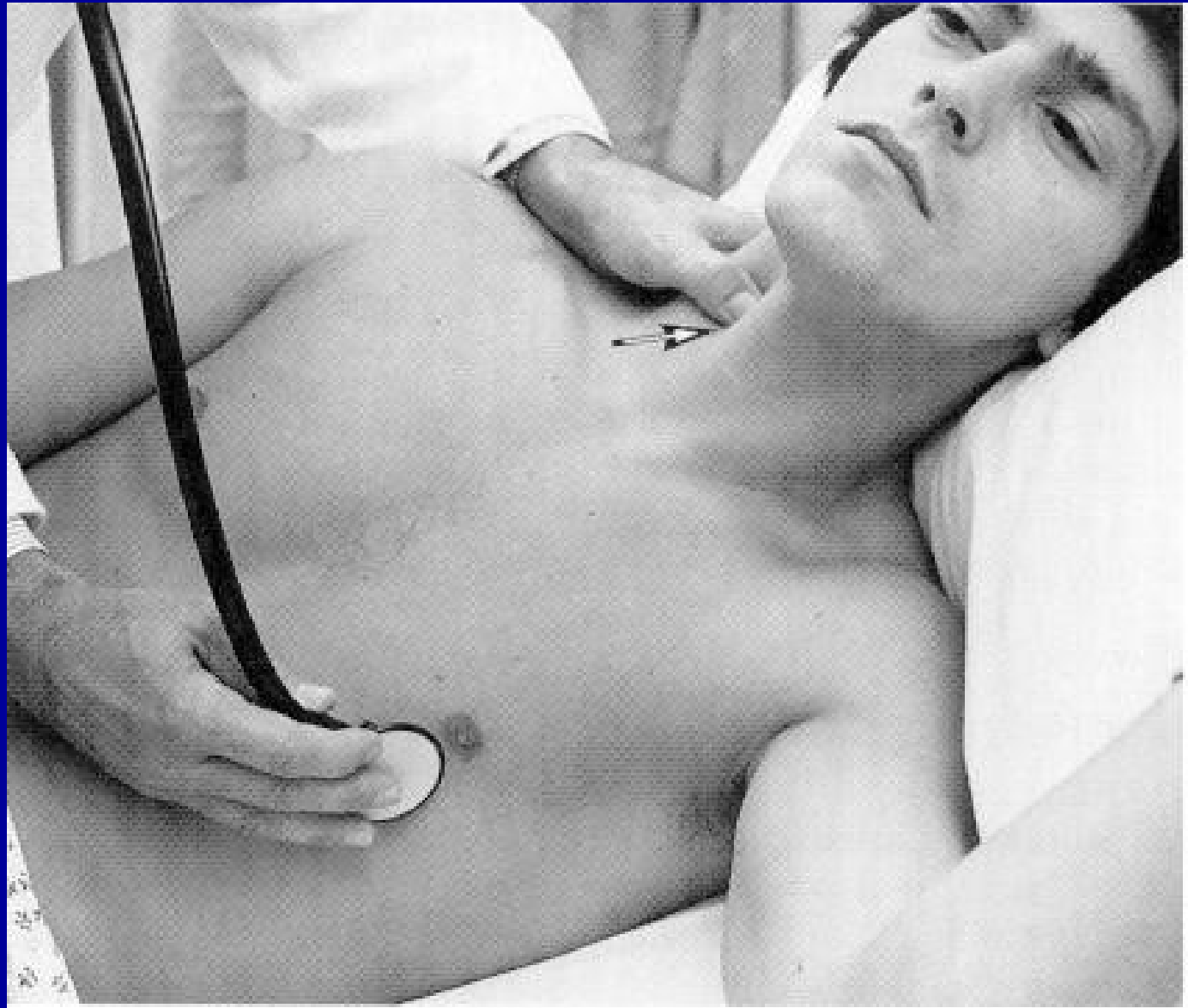
Mitral Regurgitation after MI



MR

- Radiates to axilla or back in most cases
- May radiate to the base if posterior leaflet prolapse
- Well heard with diaphragm but listen with bell also for S3 or diastolic “flow” rumble
 - Due to high volume flowing back from LA
- No change in intensity after a PVC but increases with isometric exercise and squatting (increases afterload)

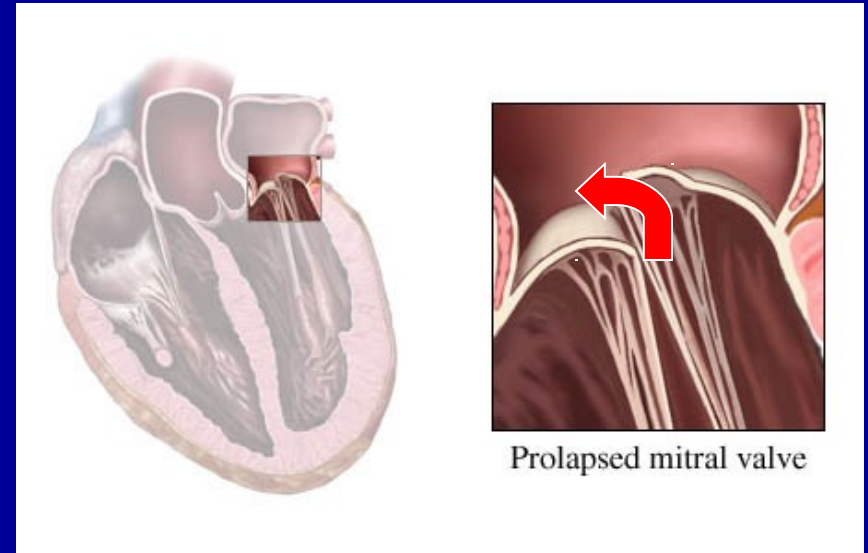
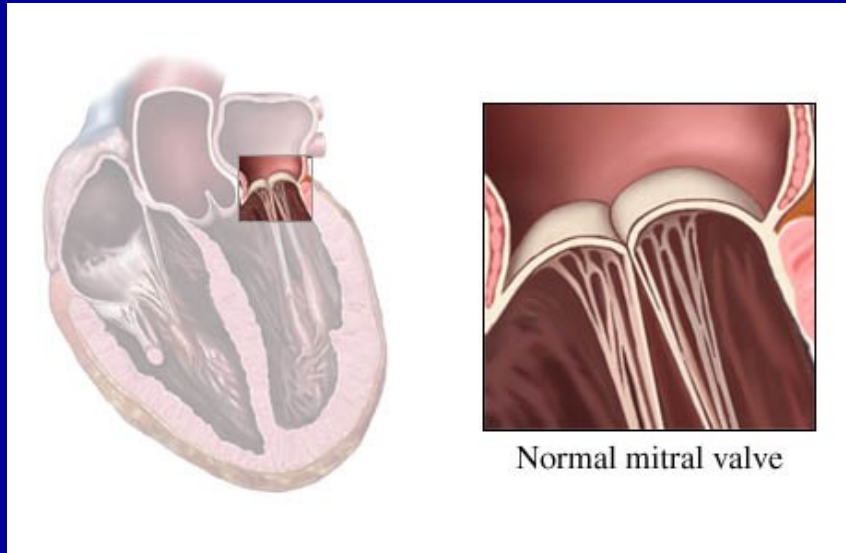
Left lateral decubitus



Signs of severity in MR

- Loud murmur (III/VI)
 - Sometimes misleading, like in acute MR
- S3 and/or diastolic rumble
- Enlarged LV impulse
 - Larger than a quarter
- Atrial fibrillation
- Signs of congestive heart failure

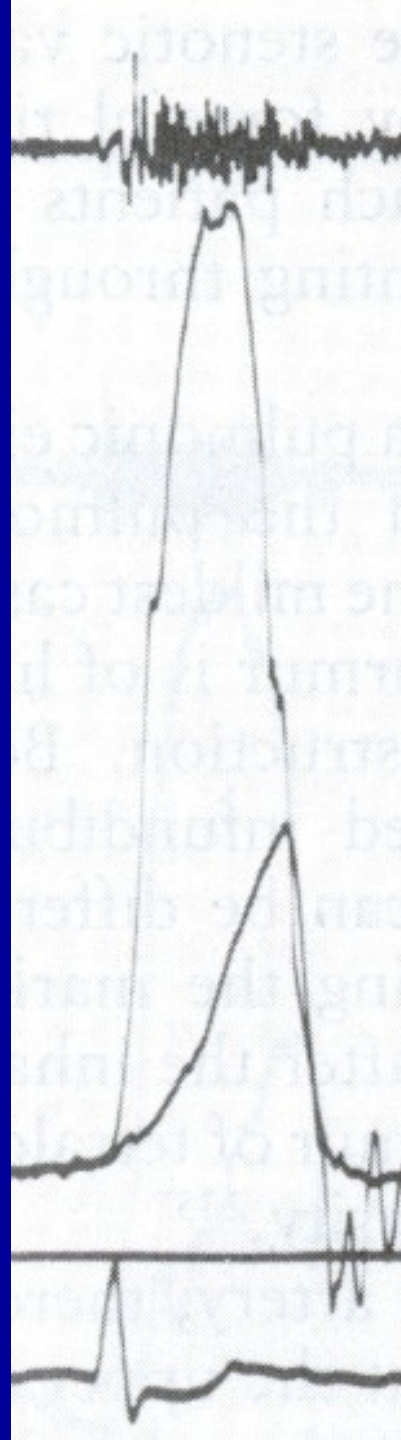
Mitral Valve Prolapse



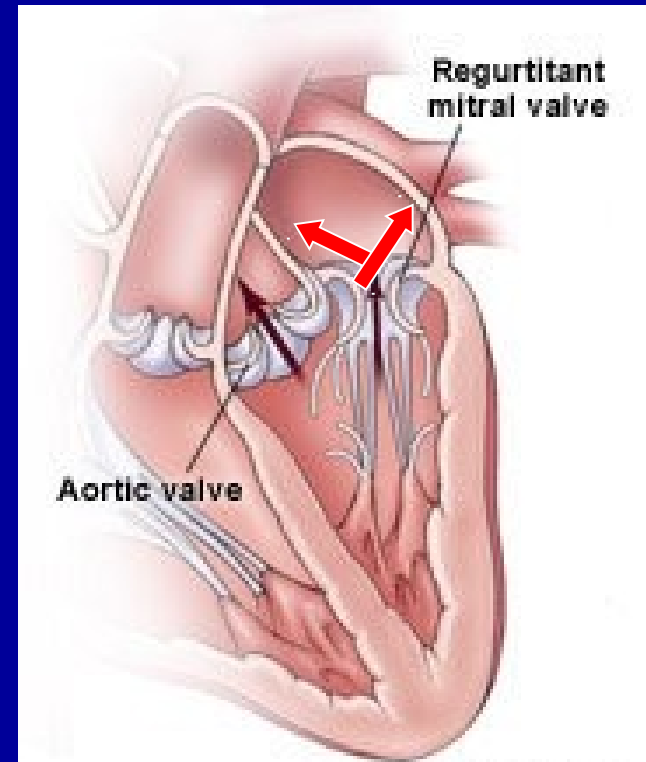
Movement of mitral leaflet into LA during systole can cause mid systolic “Click” sound

If severe enough, will cause mitral regurgitation as well. MR may NOT be holosystolic and will follow click.

- Mitral regurgitation due to dilatation or rheumatic disease tends to give a concentric jet
- MR due to prolapse tends to be eccentric and may be heard in odd locations



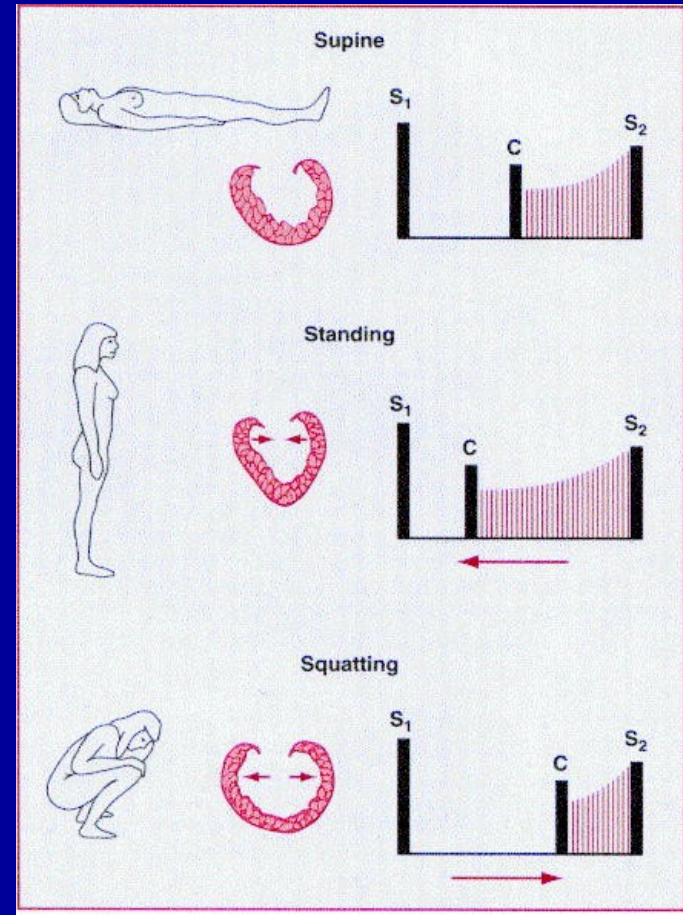
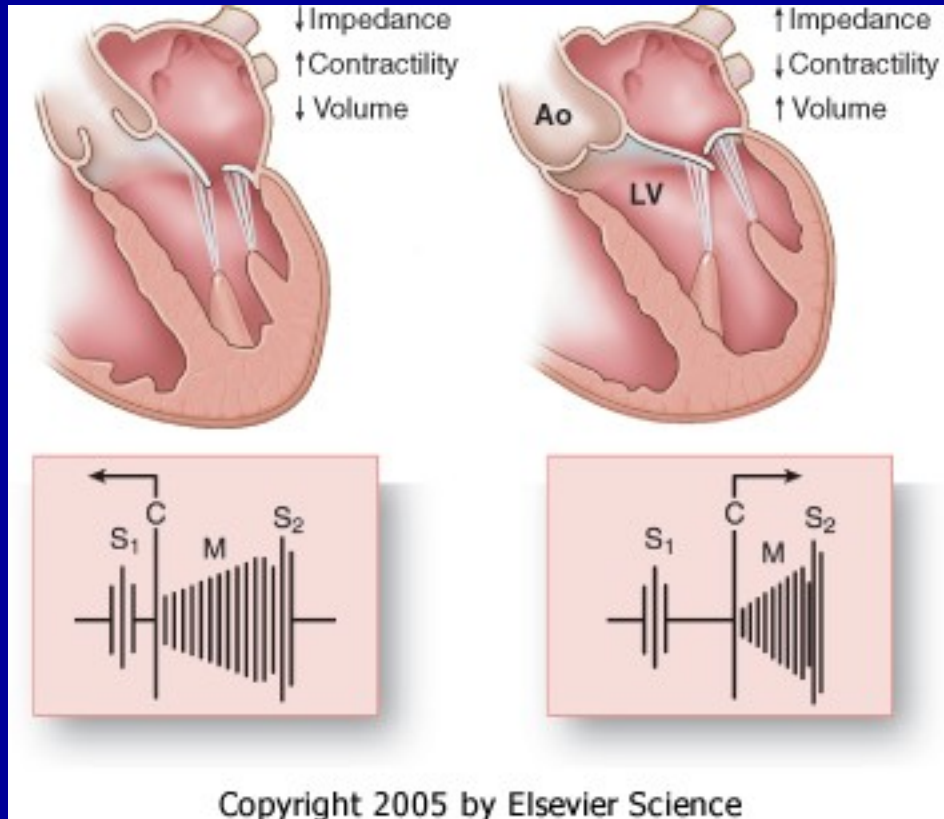
Eccentric jet



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As the heart pumps and the aortic valve opens to allow blood into the aorta, a regurgitant mitral valve allows blood to leak backward into the left atrium.

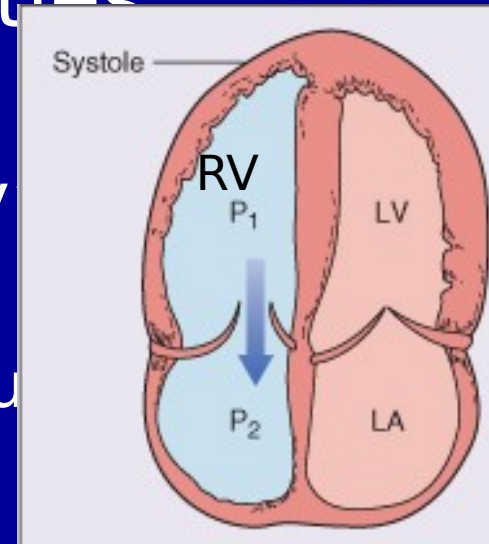
MVP: a dynamic murmur



Tricuspid Regurgitation

Etiologies

- Functional– overload
 - Pulmonary hypertension
 - RV dilatation from infarction or myopathy
- Structural– leaflet abnormalities
 - Infectious endocarditis
 - Congenital (“Ebsteins anomaly
 - Acquired
 - Carcinoid, plantain diet, ergot dru



TR Auscultatory Features

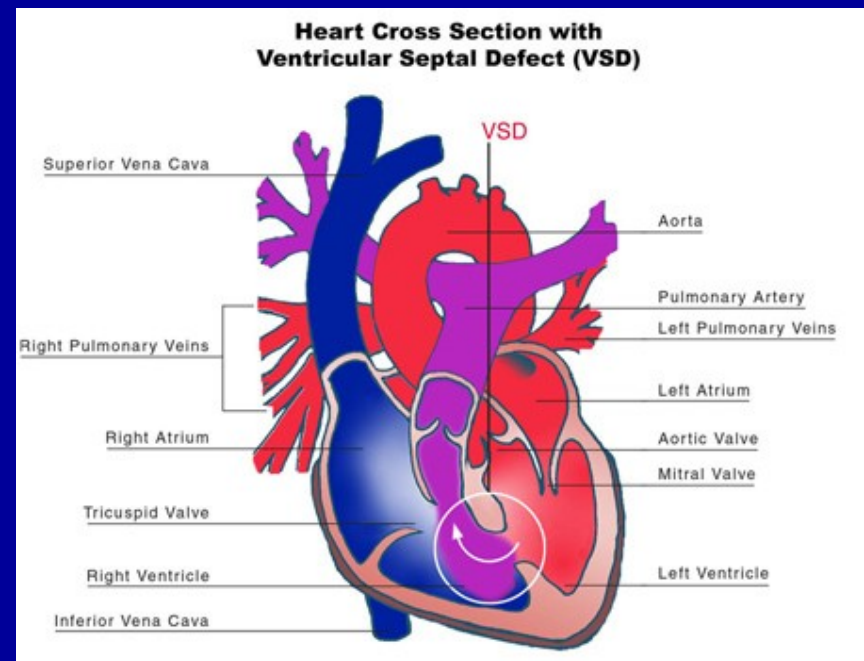
- Holosystolic murmur at lower LSB and 4th-5th interspace
- Possible S3 with flow rumble
- Intensity VARIES WITH RESPIRATION

TR: Markers of Severity

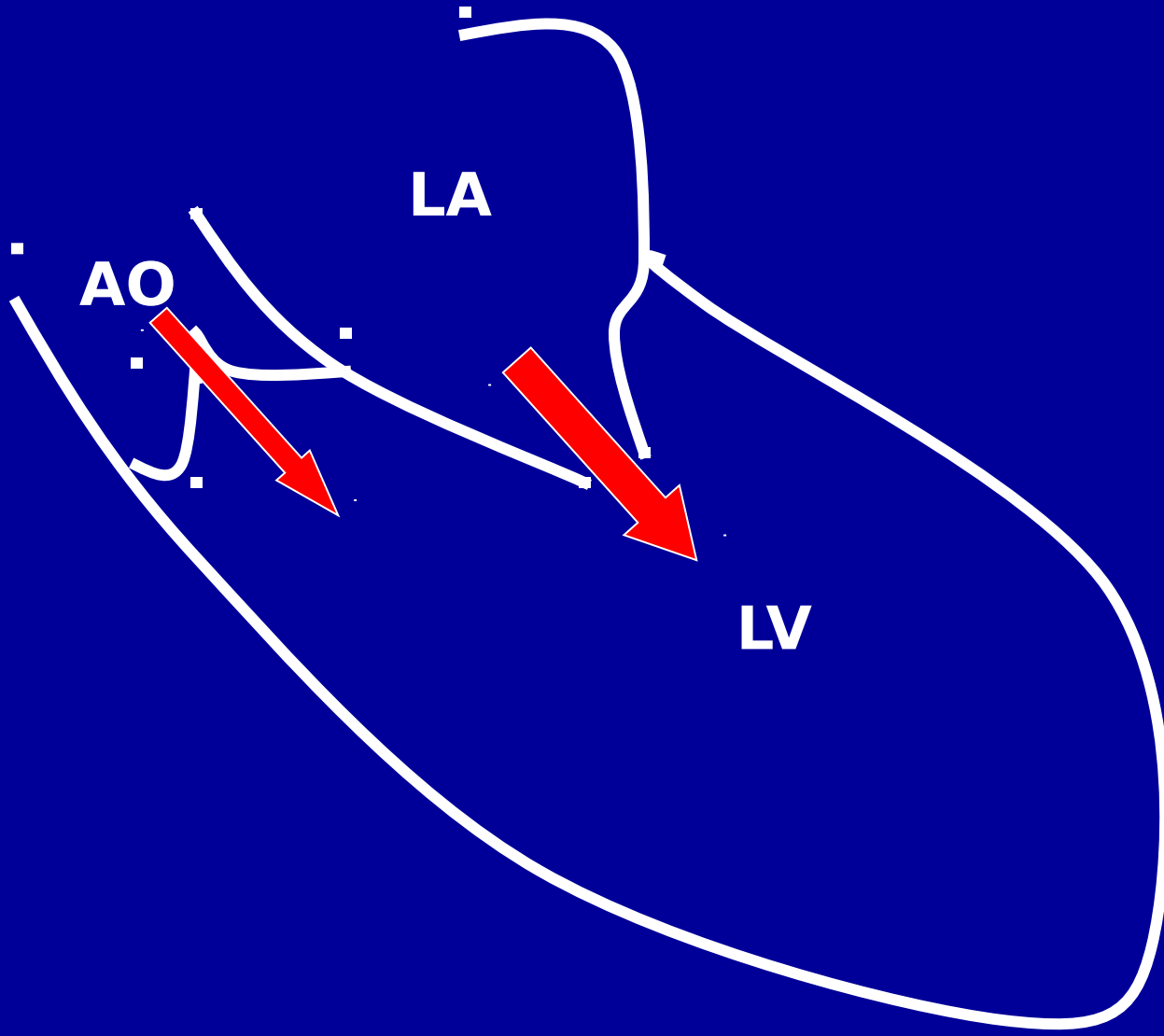
- Large pulsations in the neck veins
- Pulsatile, enlarged liver
- Widespread edema
 - Anasarca
 - “Michelin tire man”
- RV S3
 - Increases with respiration

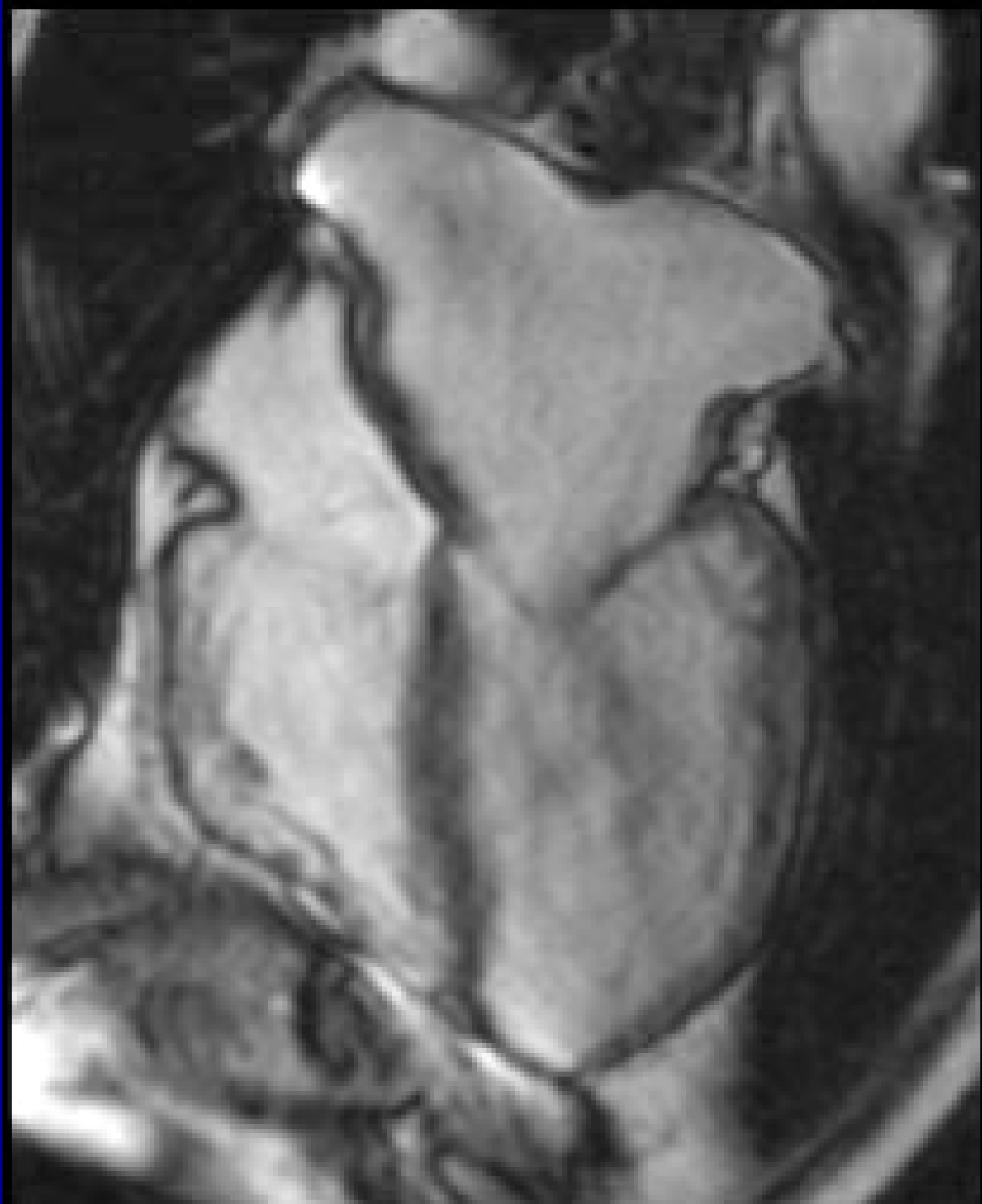
Ventricular Septal Defect

- Usually congenital; acquired due to MI or trauma
- HSM due to shunt from left ventricle-to-right ventricle
- Murmur typically at lower left sternal border



Diastole





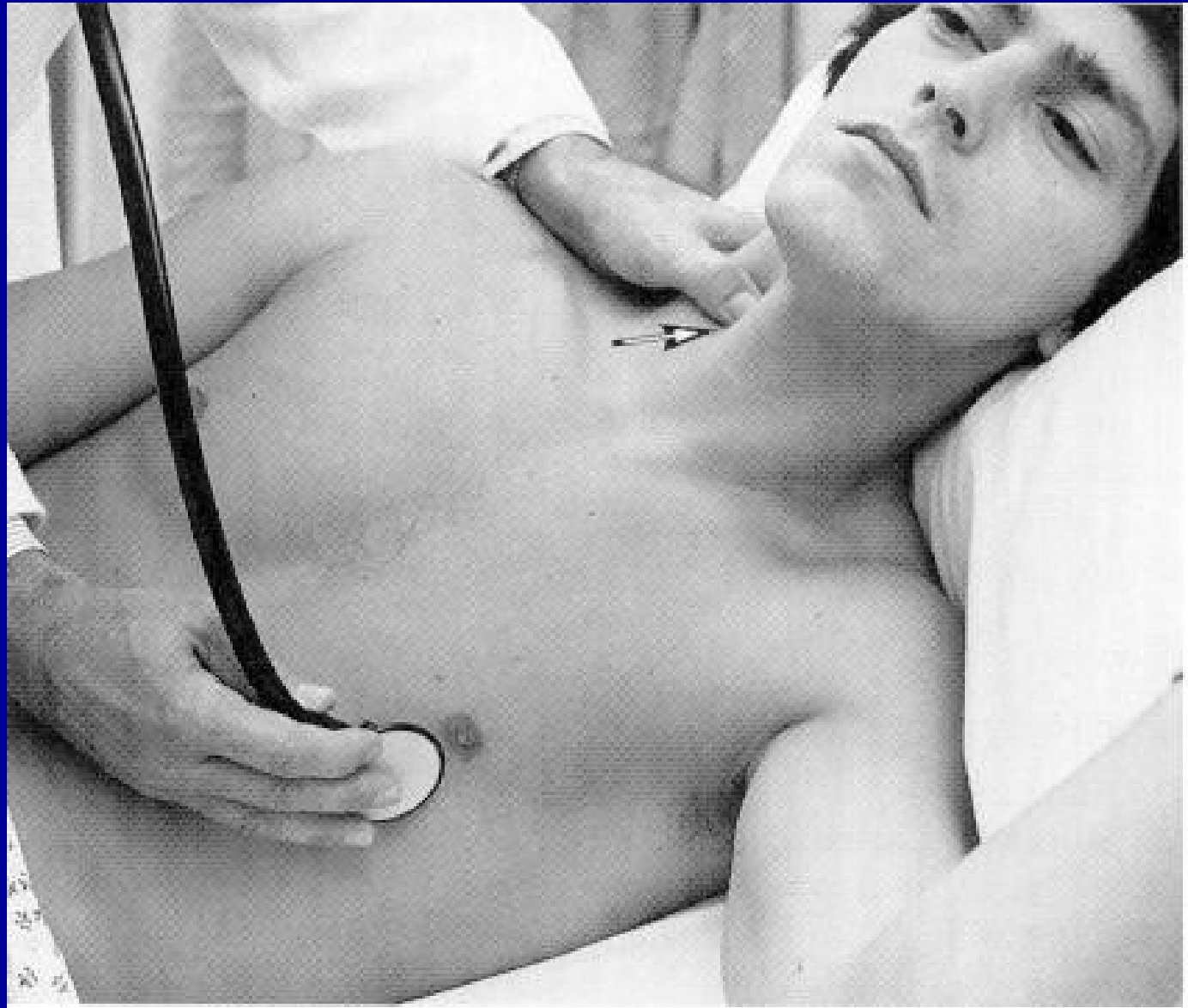
Mitral Stenosis

- “always” rheumatic in origin
- Turbulent, high velocity flow occurs during diastole
- Always look for MS in patient with new Atrial fibrillation

Mitral Stenosis

- Opening snap
- Loud S1, loud P2 if pulmonary hypertension present
- Rumbling diastolic murmur
 - heard at apex with stethoscope bell, patient in L lateral decubitus
 - Palpate carotid to identify diastole
 - Presystolic accentuation unless AFib present
 - Exercise, maneuvers to increase flow make murmur louder

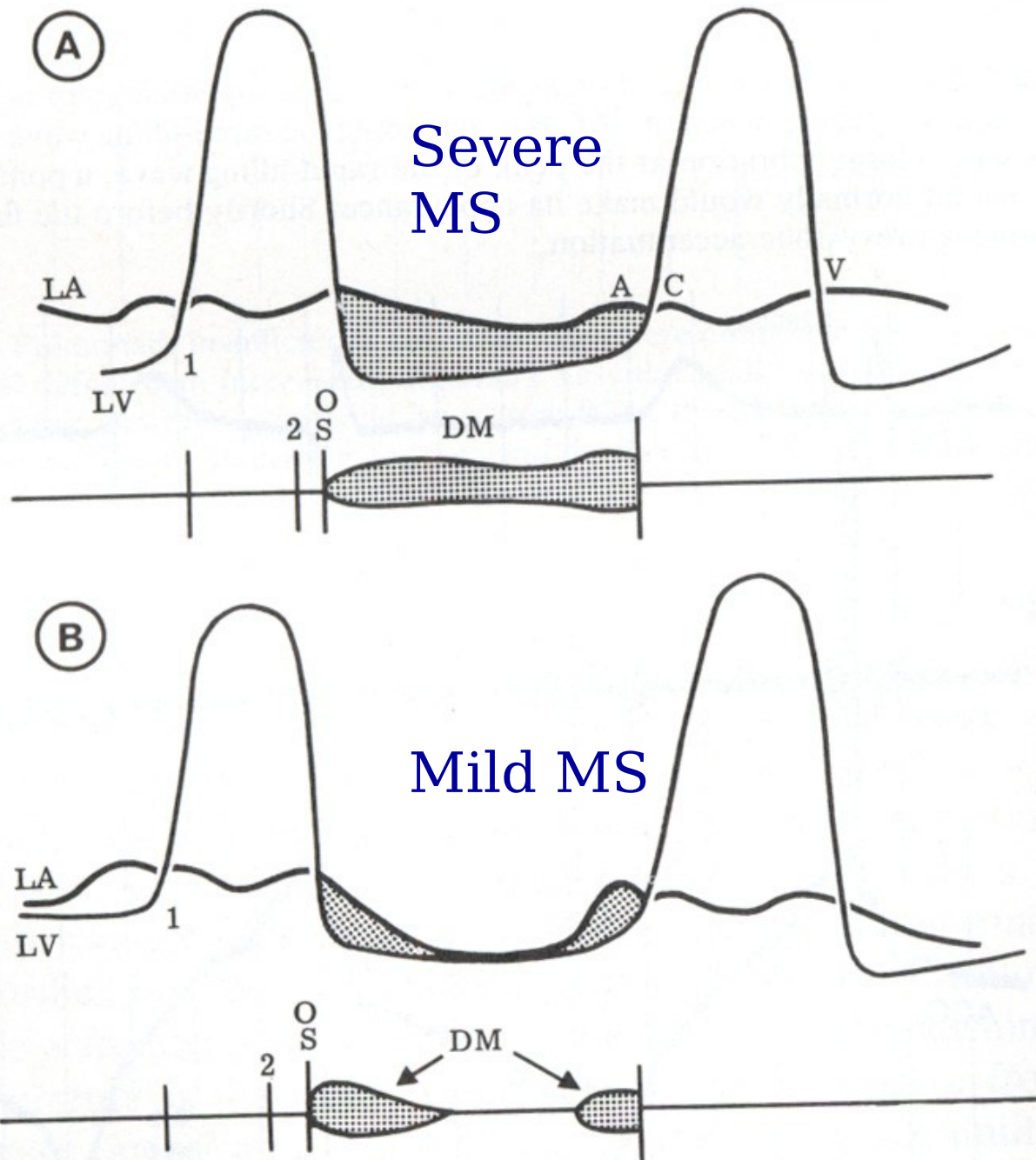
Left lateral decubitus



MS Murmur

Severe MS
associated
with pan-
diastolic
rumble,
short S2-OS
interval.

Mild MS (B)
associated
with
decrescend



Markers of Severity

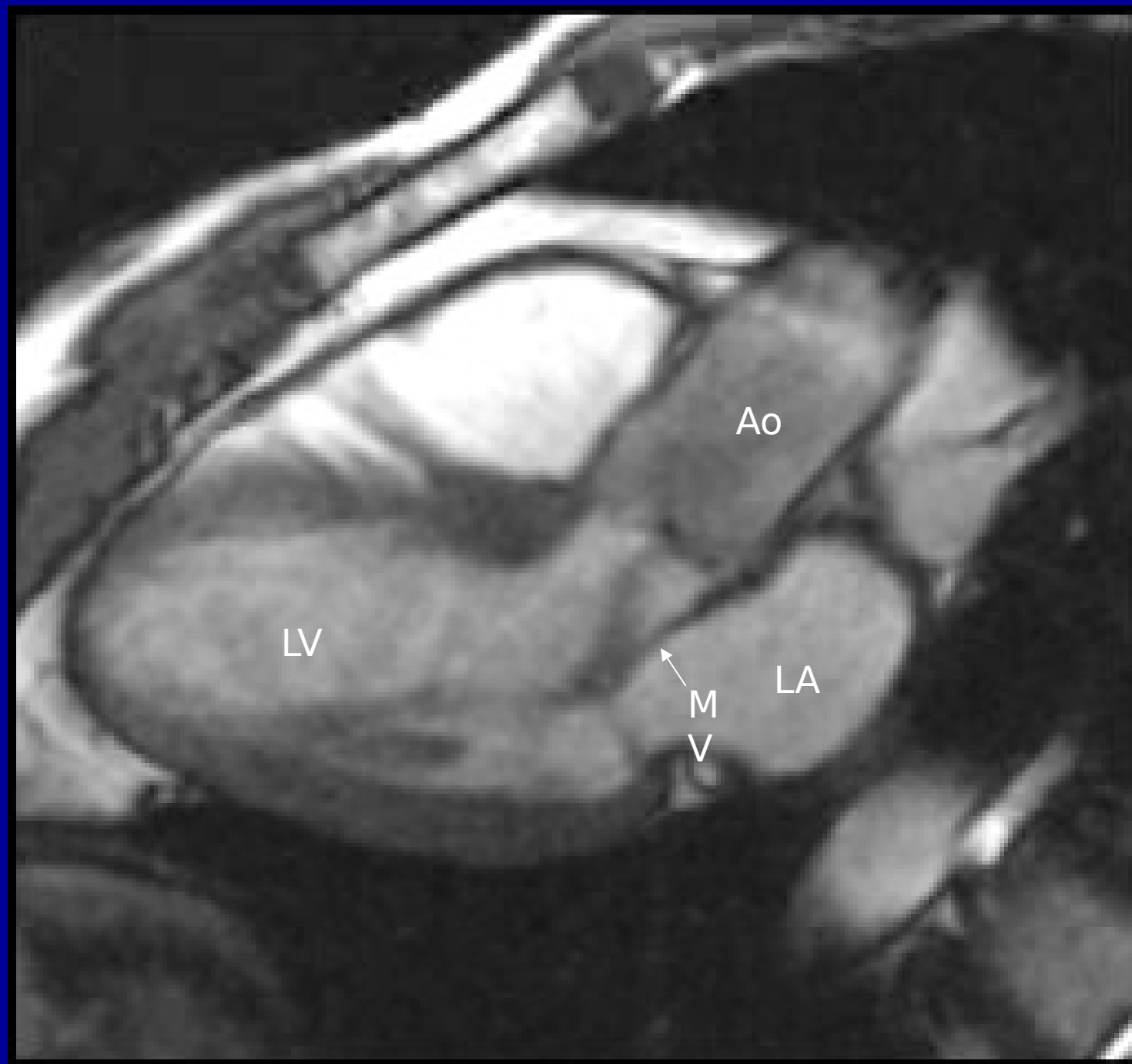
- Long diastolic rumble
- Short A2-OS interval
- Loud P2 and RV lift suggesting pulmonary hypertension
- Atrial fibrillation
- Congestive heart failure

Aortic Regurgitation

- Loss of cardiac output backwards from aorta into LV
- congenital, endocarditis, age, aortic disease, collagen vascular, syphilis
- Early diastolic, decrescendo murmur best heard at LLSB with diaphragm
 - subtle, have pt lean forward, breathe out
 - associated with wide pulse pressure

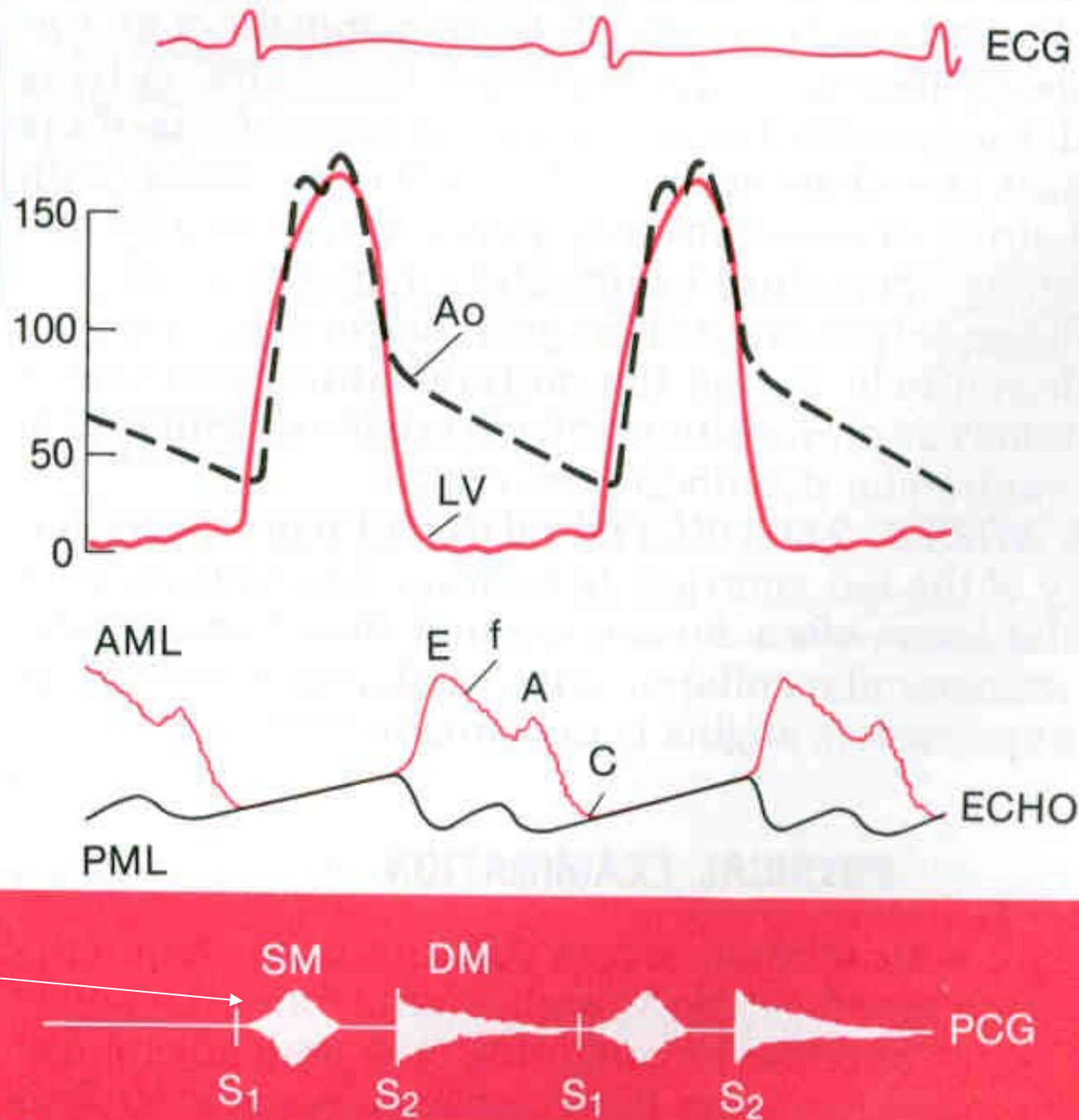
Aortic regurgitation findings

- S3
- Soft S1 and A2
- Blowing decrescendo diastolic murmur
 - Begins immediately with A2
 - High frequency (diaphragm)
 - Press firmly & concentrate
 - Inconsistent relationship between duration and severity
- Associated murmurs
 - Often has systolic ejection flow murmur
 - Austin-Flint murmur at apex sounds like mitral stenosis



Chronic AR

Early diastolic
decrecendo
murmur at
time of
greatest
pressure
difference
between Ao
and LV. Note
early systolic



AR easily missed



Additional findings

- Wide pulse pressure with low diastolic
 - “Water hammer pulses”
- Durosiez’s sign
 - To and fro bruit at femoral artery
- Hill’s sign
 - Popliteal arterial pressure > 20 mm Hg more than brachial
- Quinke’s sign
 - Nailbeds flush with systole
- de Musset's sign (Head nodding in time with the heart beat)

AR Signs of Severity

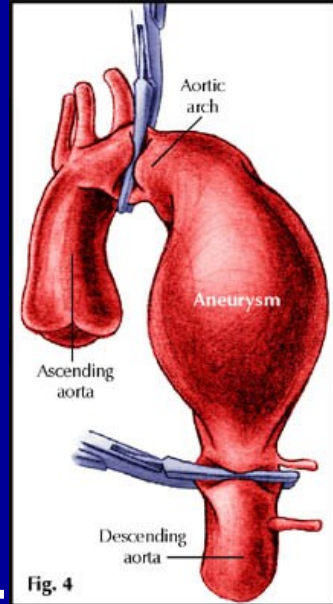
- Diastolic blood pressure less than 50
- Enlarged LV
- S3
- Signs of congestive heart failure

Case 1

- **First case**
- **18 yo airman Recruit**
- **Varsity Basketball in HS**
- **No symptoms; here for accession physical**

Marfan Syndrome

- Inherited disorder of collagen
- Associated with tall stature, wide “wing span,” ocular lens dislocation, hypermobile joints
- Cystic medial necrosis of the aorta
 - Aortic aneurysm and dissection
- Aortic regurgitation due to root dilatation
- Mitral valve prolapse



Marfan Syndrome

Fig. 1

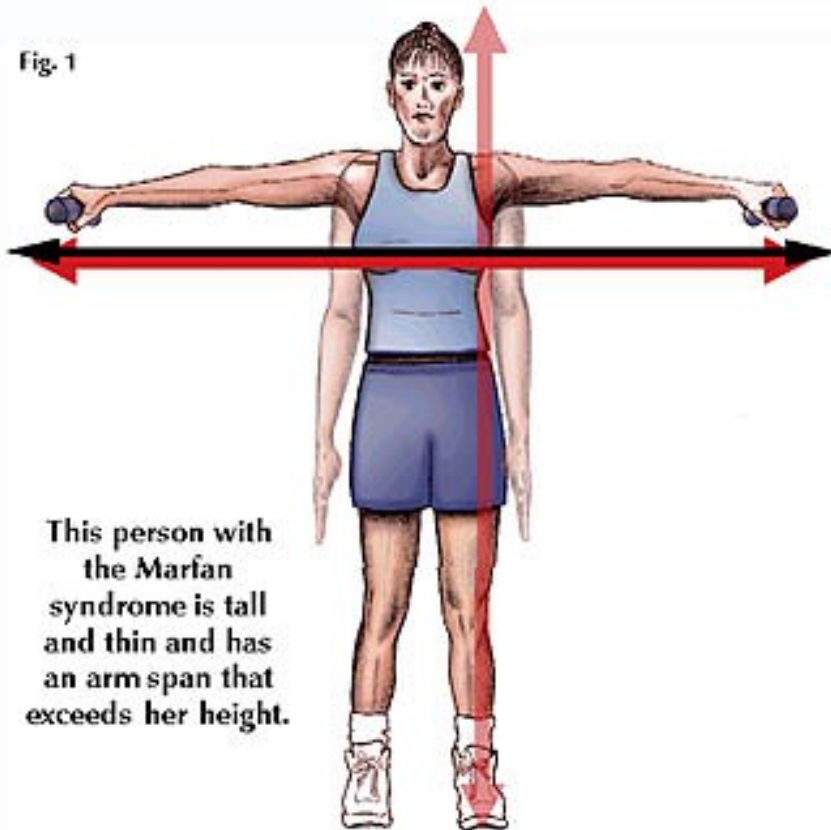


Fig. 2



Case 2

- **51 year old man**
- **Rheumatic fever at 12**
- **Heart rhythm disorder found after transient loss of speech 6 mos ago**
- **Recently tired and short of breath**

Mitral stenosis



Atrial
appendag
e

Case 3

- **40 year old male**
- **Murmur detected on and off for many years**
- **Notes that he is not able to exert himself like formerly; attributes it to getting old**

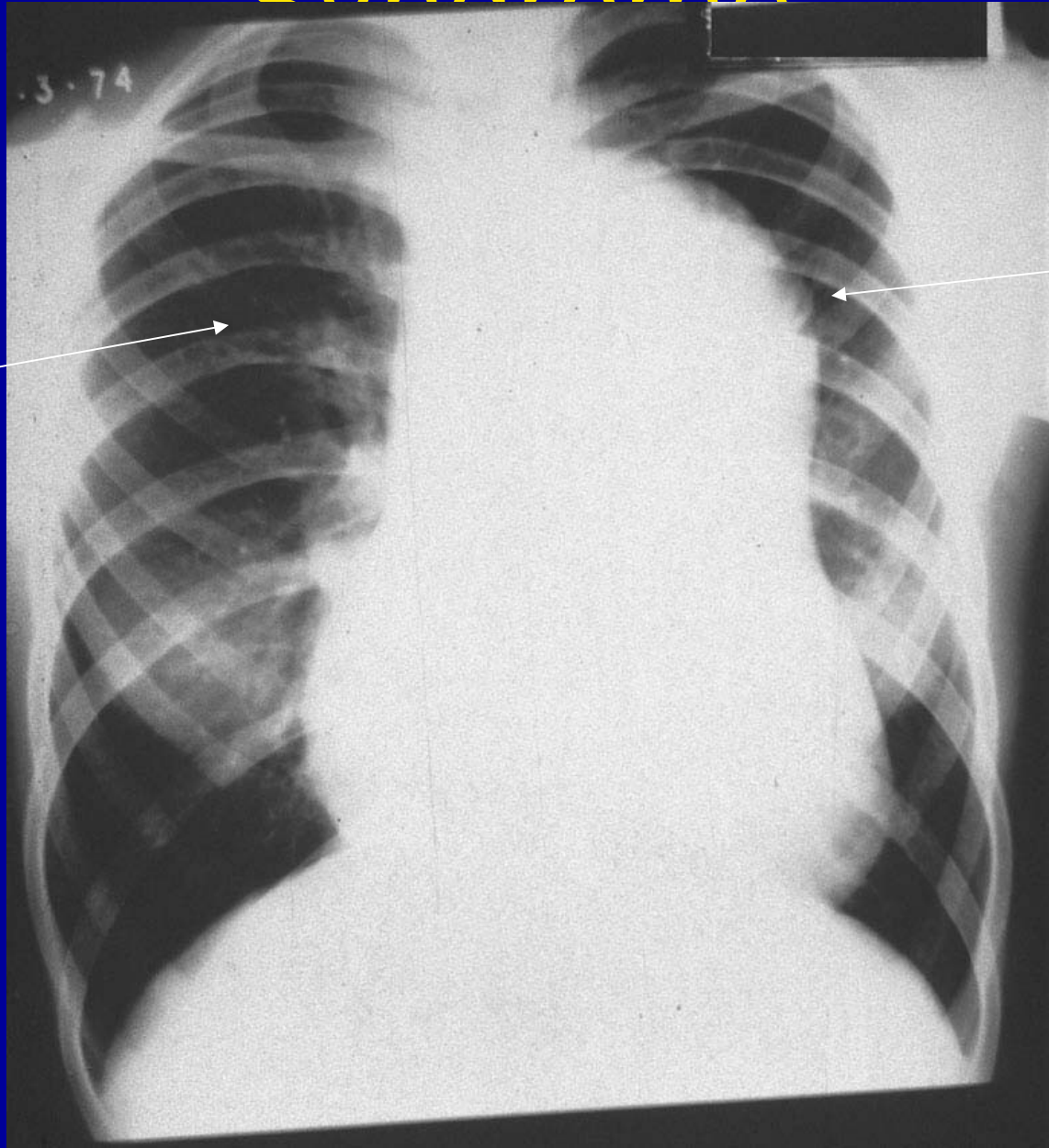
Atrial Septal Defect

- Often asymptomatic into middle age
 - Insidious progression to Eisenmenger's syndrome if not picked up
- Typically see significant improvement in exercise tolerance post-correction
- Many can be closed percutaneously
- Fixed split S2 and midsystolic flow murmur early; loud P2 later as pulmonary pressures increase

ASD, Eisenmenger Syndrome

Oligemia

PA Aneurysm



Case 4

- **22 year old male**
- **Murmur noted at age 9**
- **Fainted during touch football game**

Syncope and murmur

- AS, HOCM, MS, pulmonic stenosis associated with cardiovascular syncope
 - Mechanical obstruction of cardiac output
 - Can lead to extreme intracardiac pressures and/or ischemia
 - Before Ao valve surgery, 75% of AS patients died suddenly

Case 5

- **63 year old woman**
- **Enlarged heart for two years**
- **Notes increasing difficulty carrying groceries over 6 months**
- **Episodes of irregular heart action over past two months**

Mitral Regurgitation

- No proven medical therapy to prevent progression
- Chronic volume overload causes atrial dilatation, fibrillation
 - Less prone to stroke than MS; ?MR jet scrubs the left atrium
- Chronic volume overload causes ventricular dilatation, failure
 - Need to operate when EF <60%